

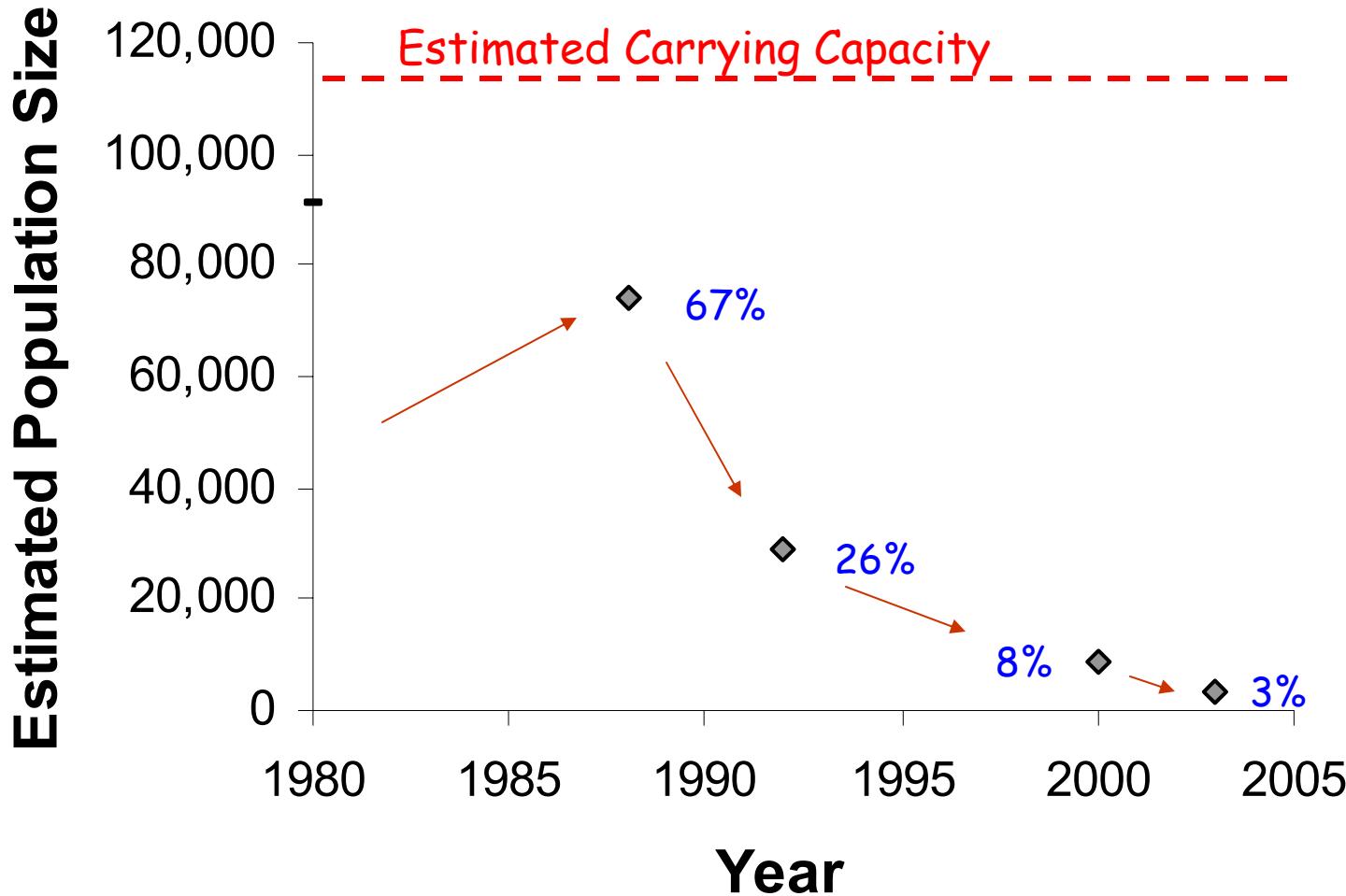
# Sea otter studies in the Aleutian Islands



Synopsis of recent findings

Bryant Austin © 2001

# The Aleutian Islands

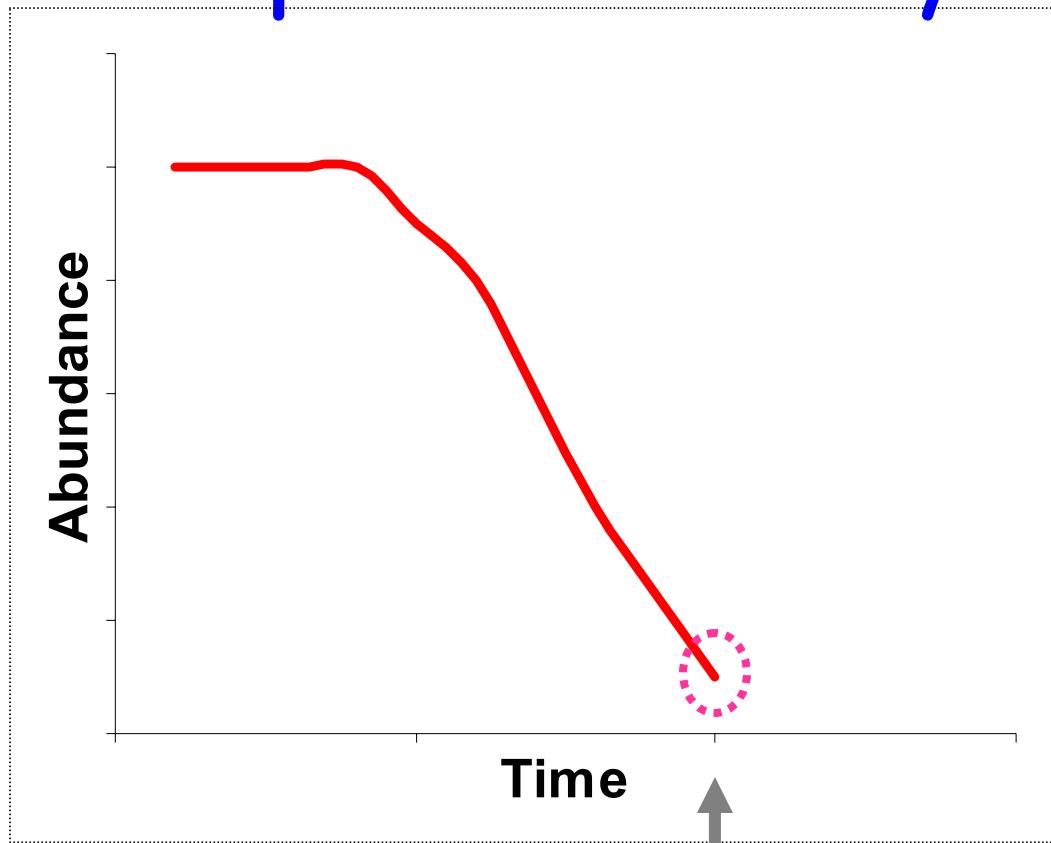


# Aleutian Islands

## 1. General purposes

- i. To continue monitoring sea otter population trends
- ii. Field studies of sea otters and coastal ecosystems
- iii. Retrospective analyses of sea otter and coastal ecosystem—to understand changes that have led to current patterns

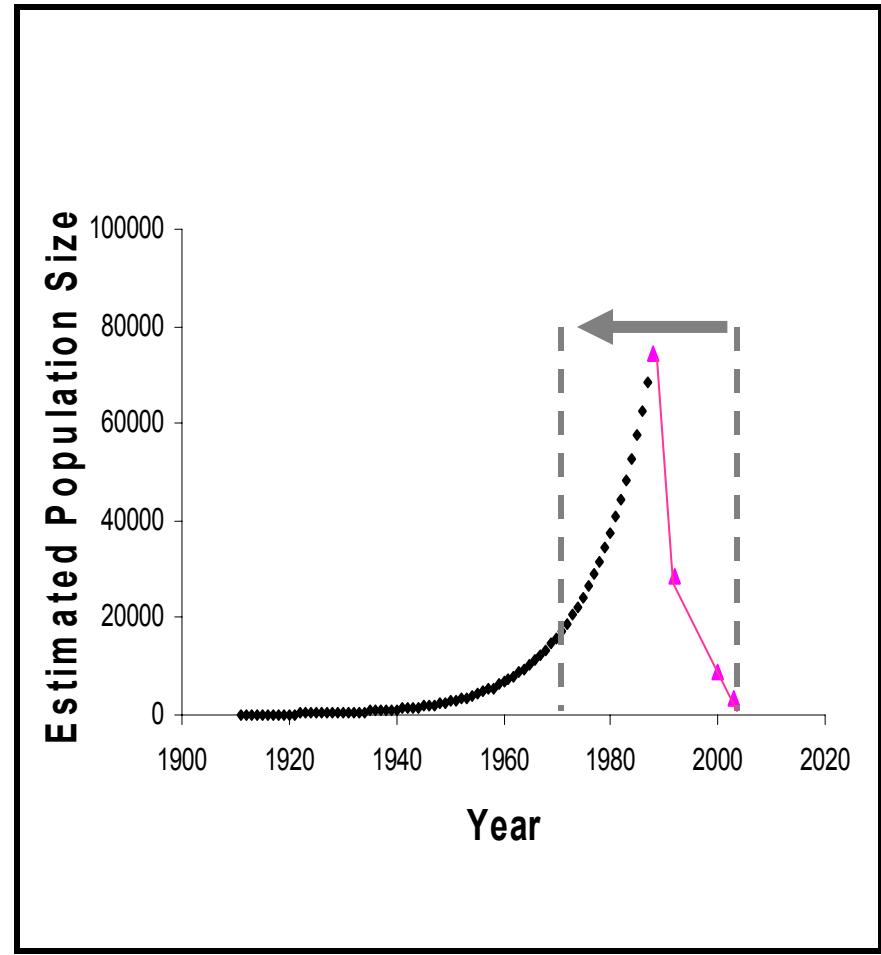
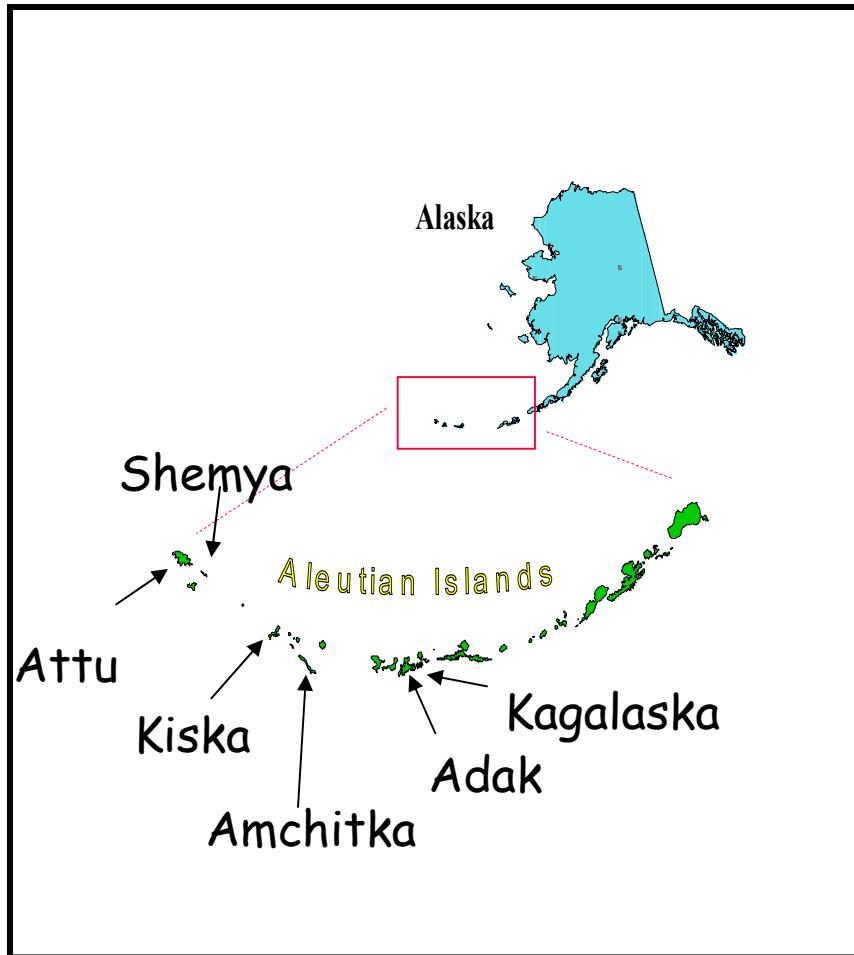
# Retrospective analyses



? → problem, no points of comparison;  
a static perspective

# Purpose:

to provide such analysis for sea otters in the Aleutian archipelago for data obtained over past 35 years



# General Methods

Prey abundance--*SCUBA*

Age—*tooth sections*

Morphometrics—*body length and mass*

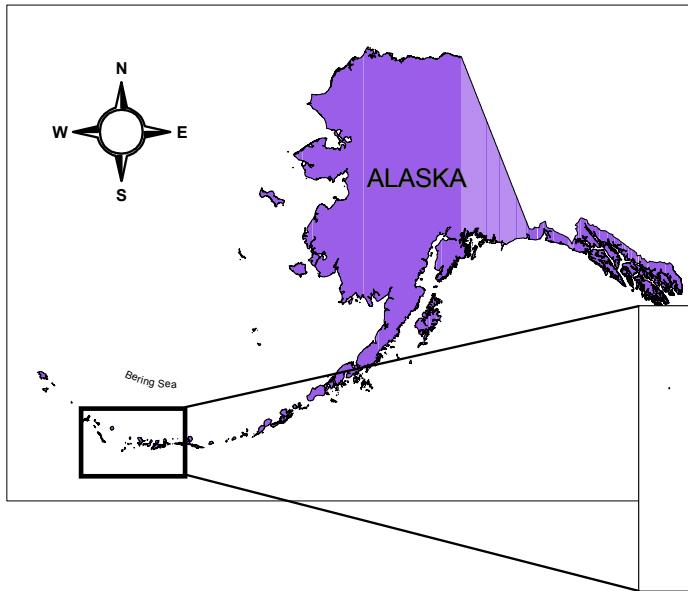
Behavior—*radio telemetry; direct*

*observation; spatial analysis*

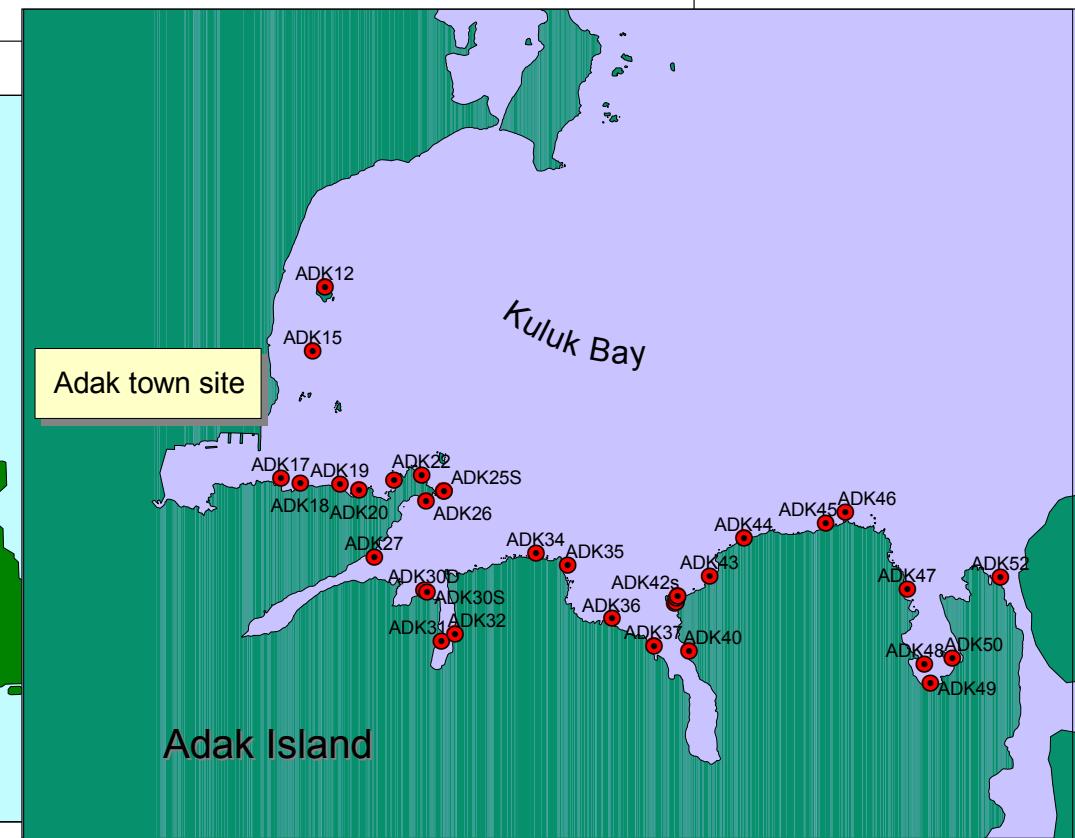
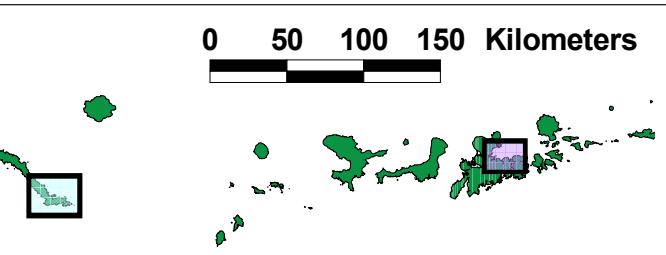
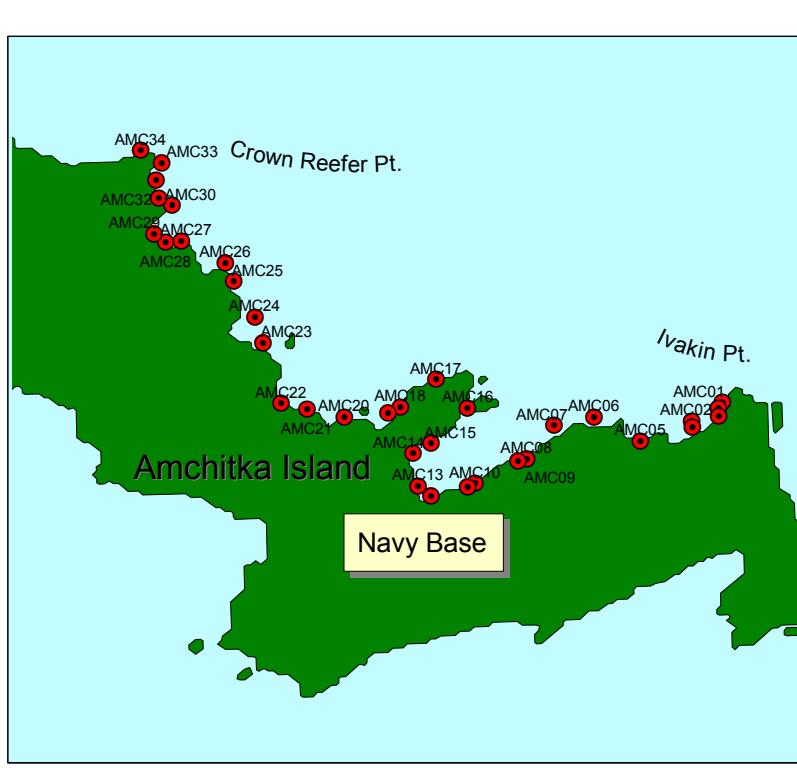
$$\Delta x = f(\%K)$$

Prey availability?

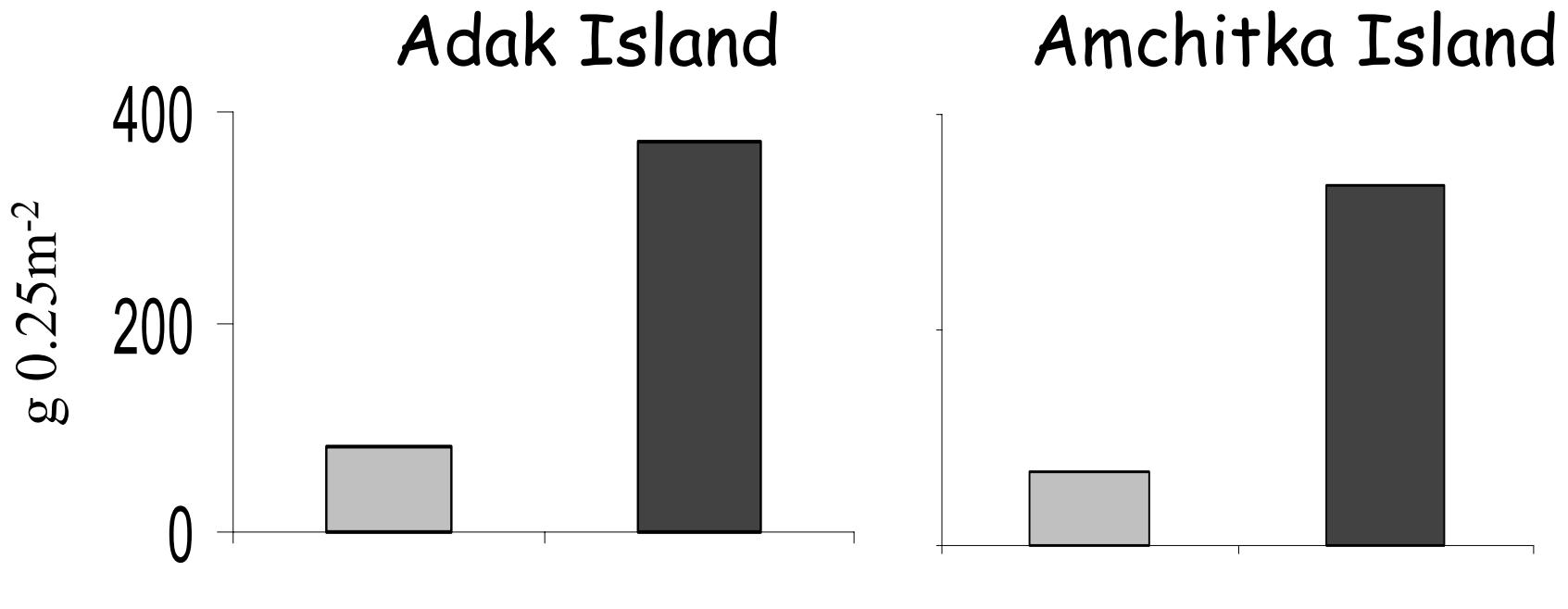
# Adak and Amchitka Benthic Sampling Sites



0 50 100 150 Kilometers



# Sea urchin biomass



-- mid 1980s; before decline (**100% K**)



-- late 1990s; after decline (**~ 5-10% K**)

# Body Condition?

# Data

Length and Mass at age (females only)

<u>Period</u>	<u>No. individuals</u>
1967-71	1,199
1992-97	142
2004	9

# von Bertalanffy growth equation

$$A_{\infty} \left( 1 - e^{-k(t-t_o)} \right)$$

*Asymptotic size*      *Growth rate*

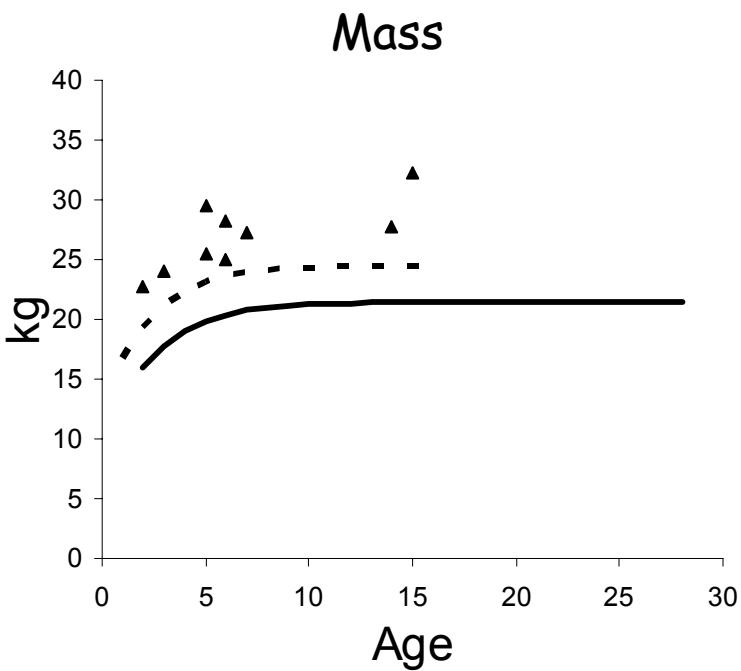
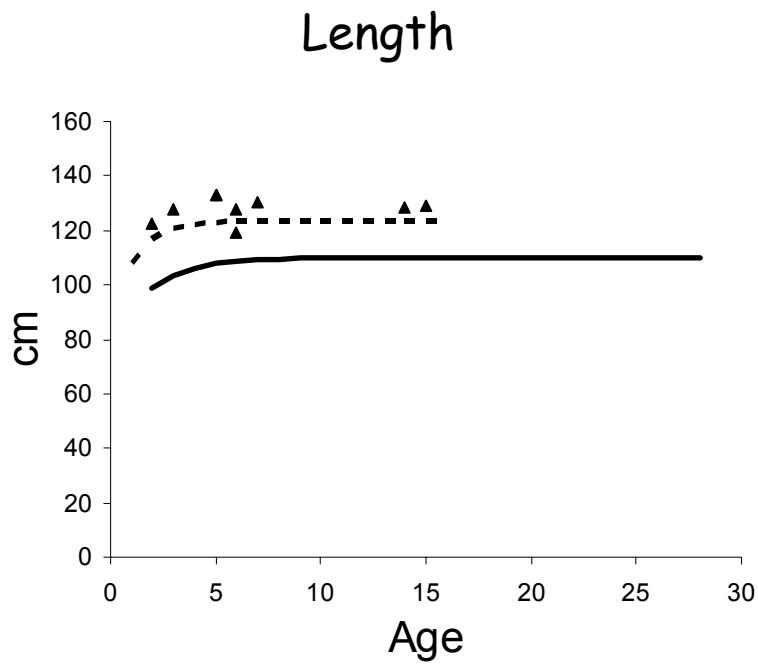
The diagram shows the von Bertalanffy growth equation:  $A_{\infty} \left( 1 - e^{-k(t-t_o)} \right)$ . Two teal-colored arrows point from labels to specific terms in the equation. One arrow points from the label "Asymptotic size" to the term  $A_{\infty}$ . Another arrow points from the label "Growth rate" to the term  $-k(t-t_o)$ .

%K

1967-71 — 100

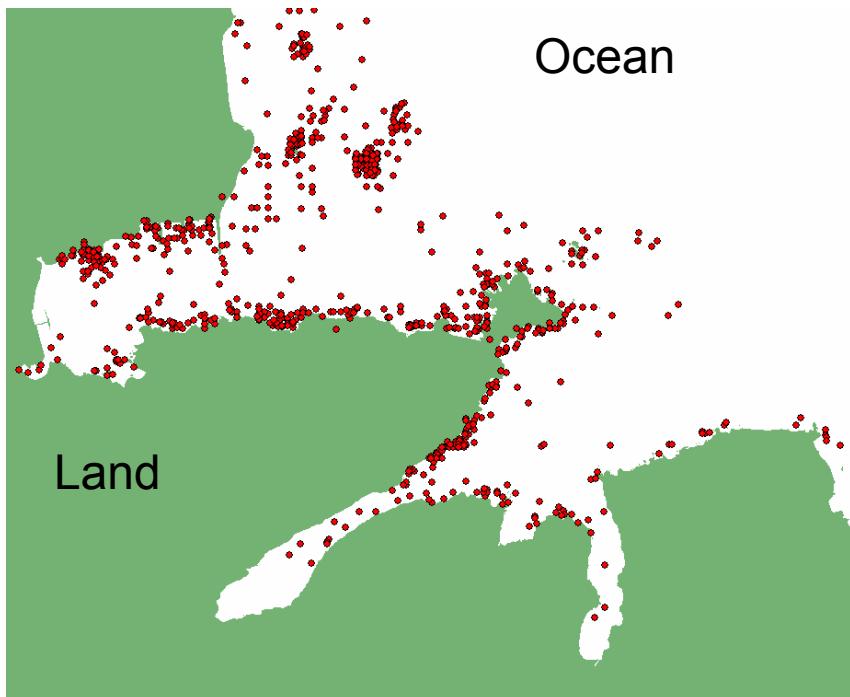
1992-97 - - - 20-50

2004 ▲ 3-5

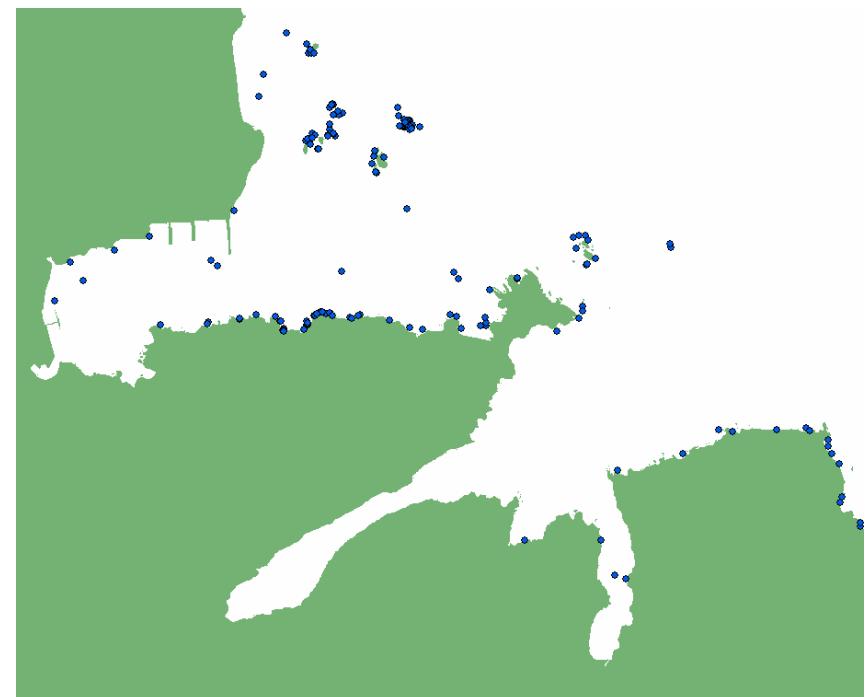


# Habitat Use?

# Distance from shore

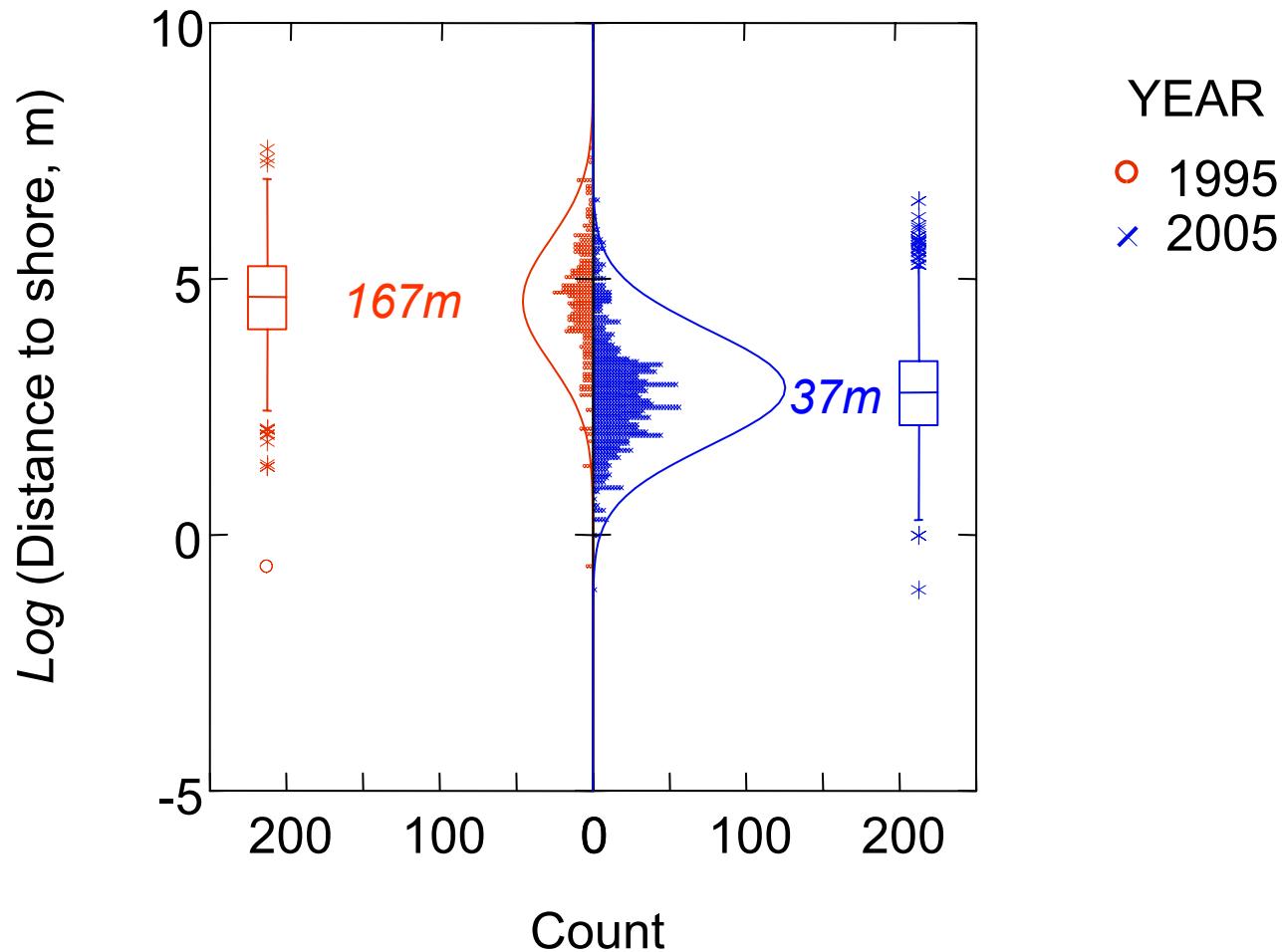


1995



2005

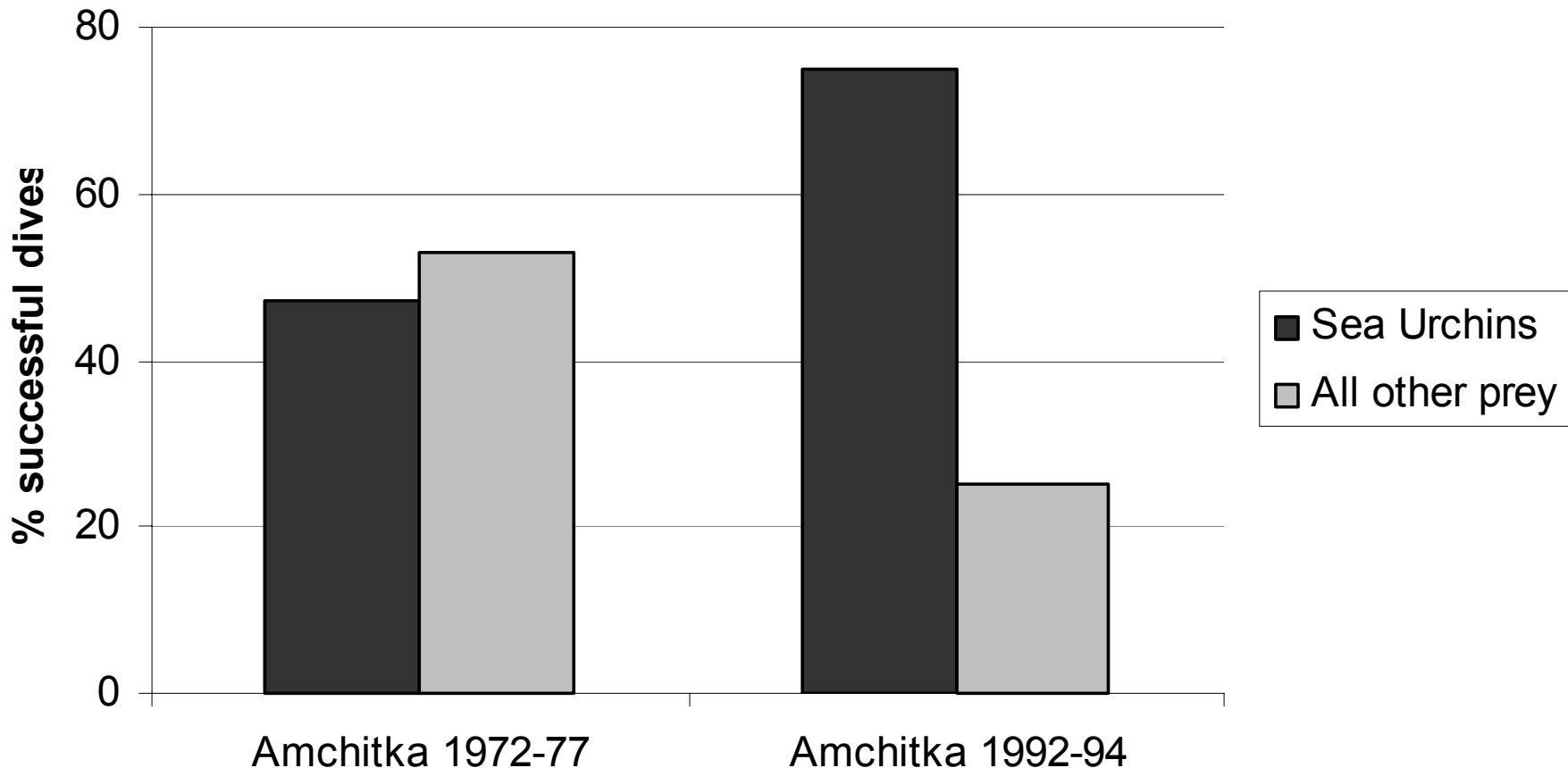
# Distance to Shore, Adak I.



# Foraging Behavior?

- Diet
- Foraging bout length
- Activity-time budget

# Diet?

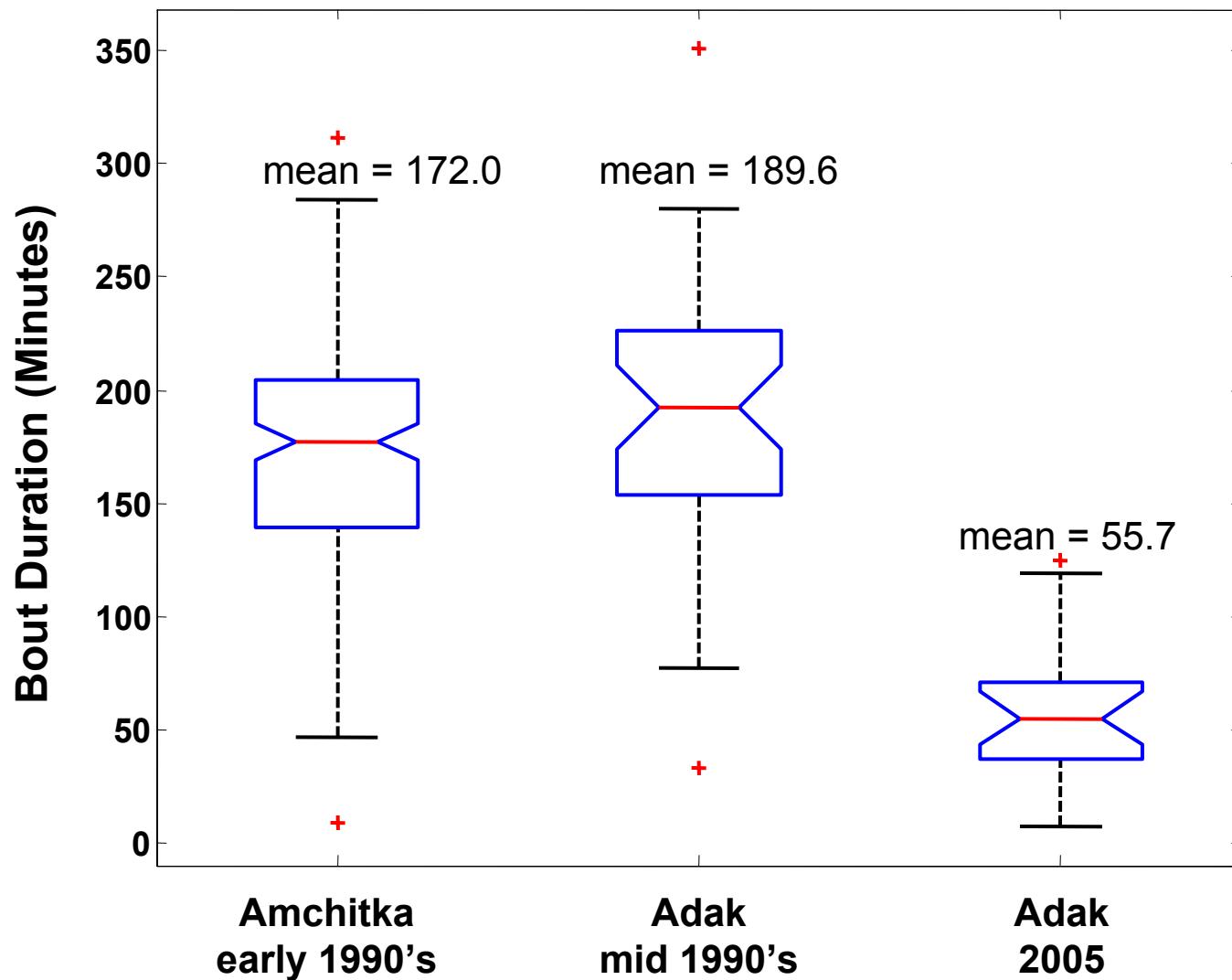


%K

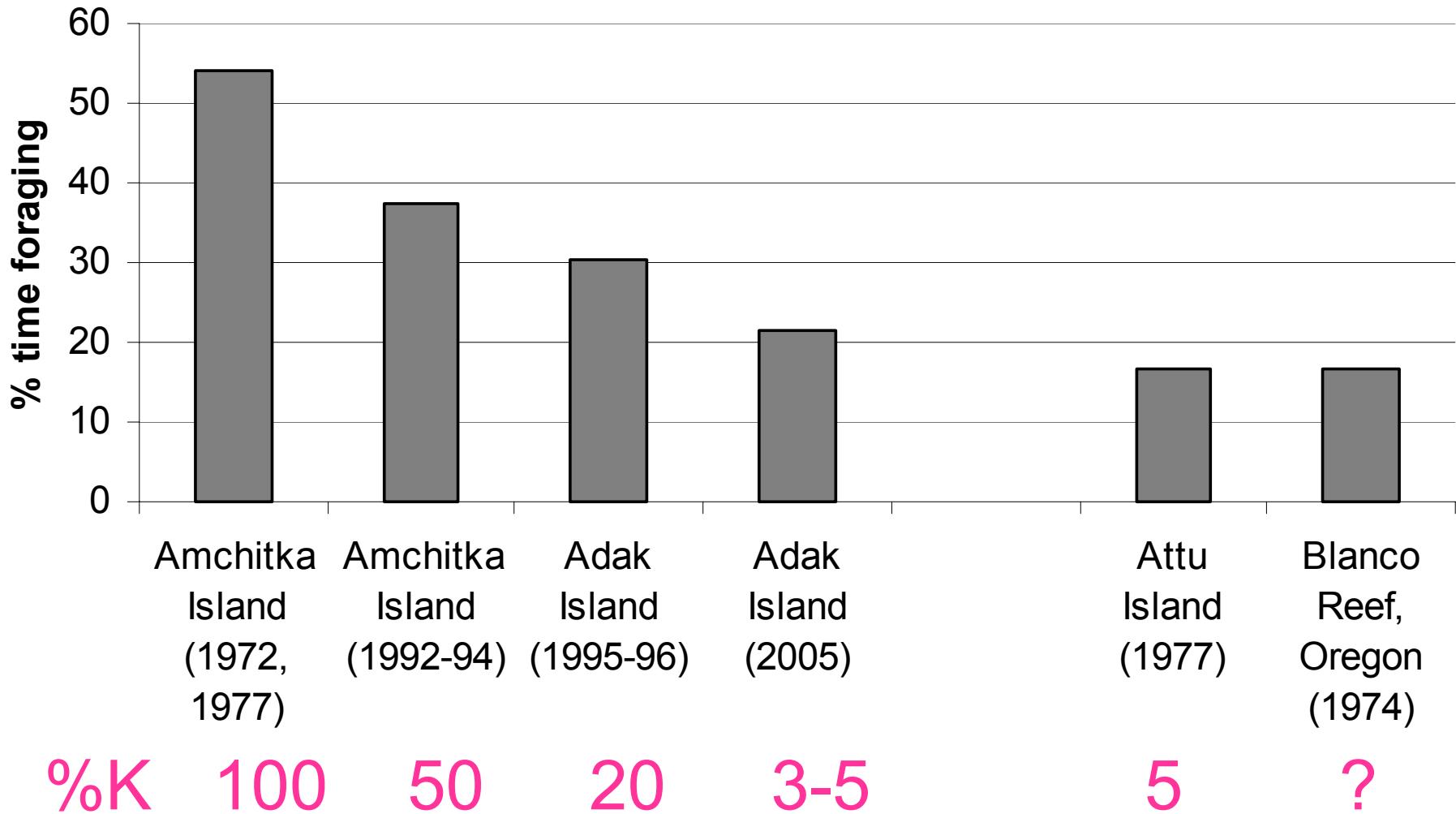
100

50

# Foraging bout length?



# Activity-time budgets?



# Summary of Findings

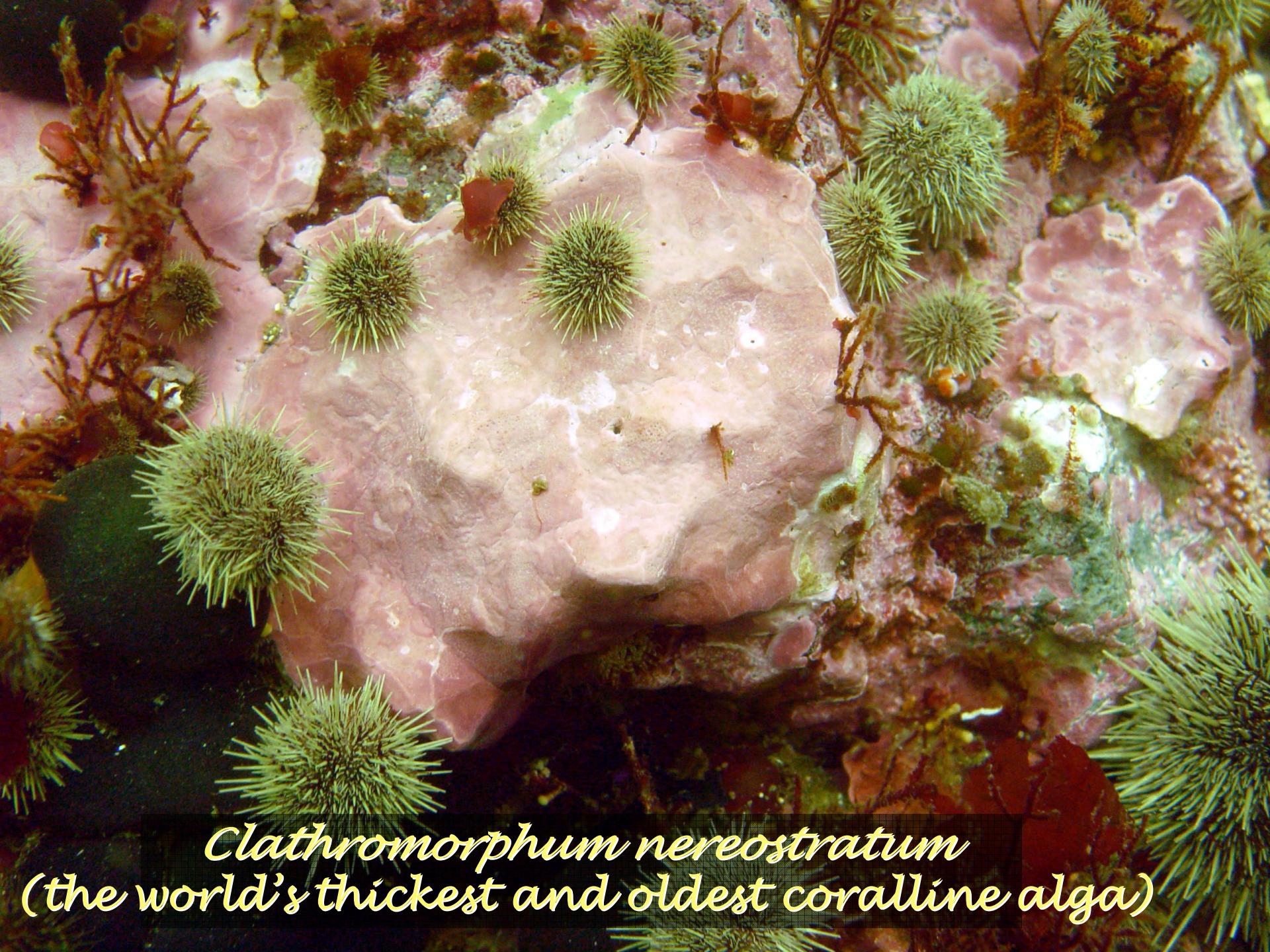
- Prey abundance *increased*
- Body condition *improved*
- Habitat use *closer to shore*
- Dietary diversity *declined*
- Time spent foraging *declined*
- Foraging bout length *declined*

# Conclusions

- These data—do not speak to question of specific cause
- However, consistent with top-down rather than bottom-up forcing

# Future Plans

1. Continue population monitoring
2. Continue retrospective data analyses
3. Study of the encrustine coralline alga,  
*Clathromorphum nereostratum*, a time  
machine.



*Clathromorphum nereostratum*  
(the world's thickest and oldest coralline alga)



# Surface of conceptacle field

2004

2003

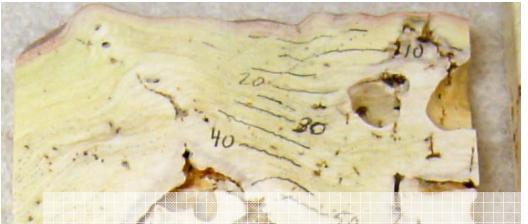
Previous year's buried conceptacles

Attu Island: 136 years old



Specimen 11-4

216 years old



*This coralline alga was  
growing here in 1737!*



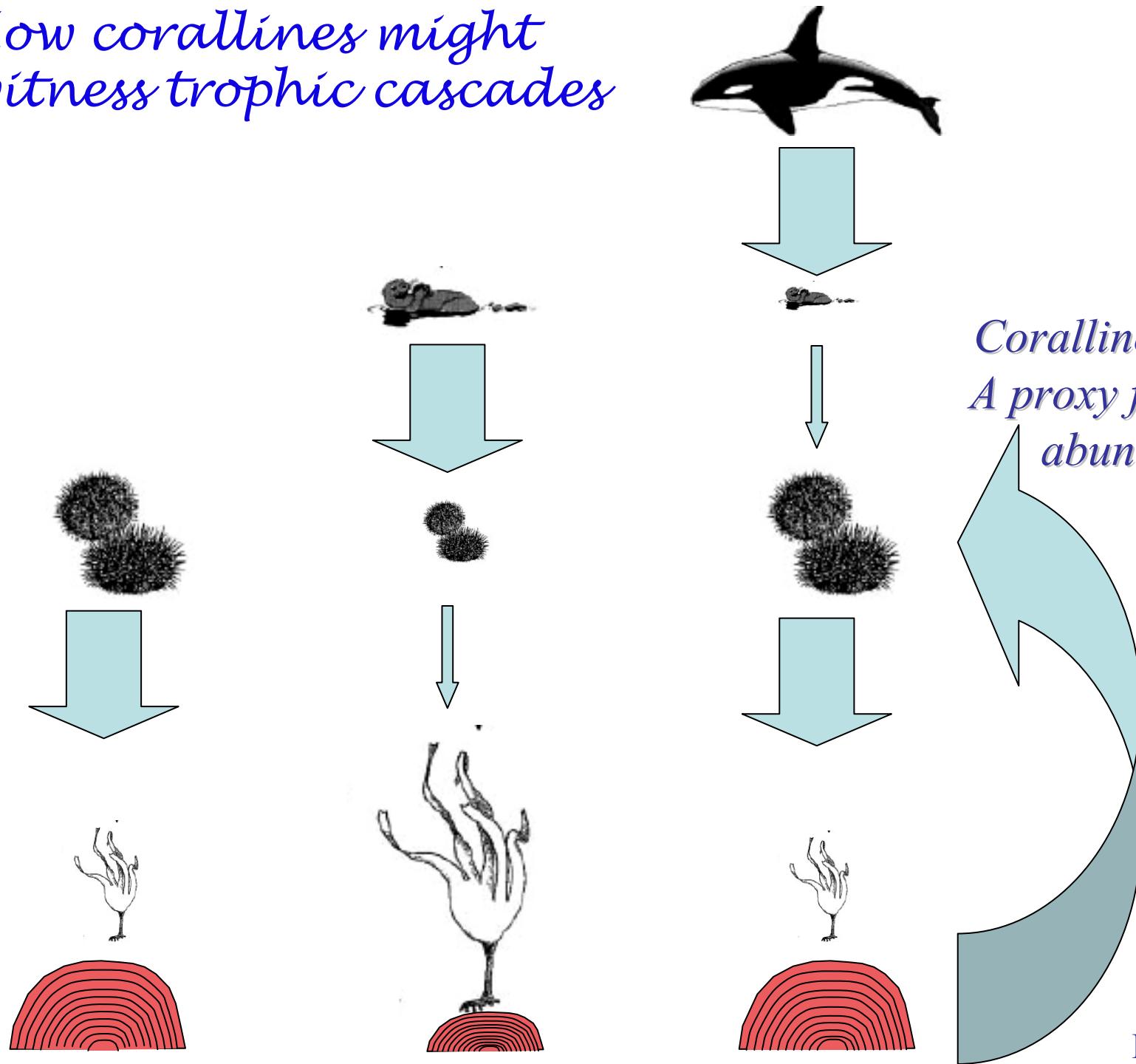
244 years old



267  
years  
old



# How corallines might witness trophic cascades



*Coralline growth:  
A proxy for urchin  
abundance*

Warmer

## Northern Hemisphere temperature record

0.4  
0.2  
0.0  
-0.2  
-0.4

Cooler

1700

1800

1900

2000

1810-1820

1900

1970 -1990

Interpreted Temperature  
(Based on  $^{18}\text{O}$ )

The Little Ice Age

7.50  
7.00  
6.50  
6.00  
5.50  
5.00  
4.50  
4.00  
3.50  
3.00

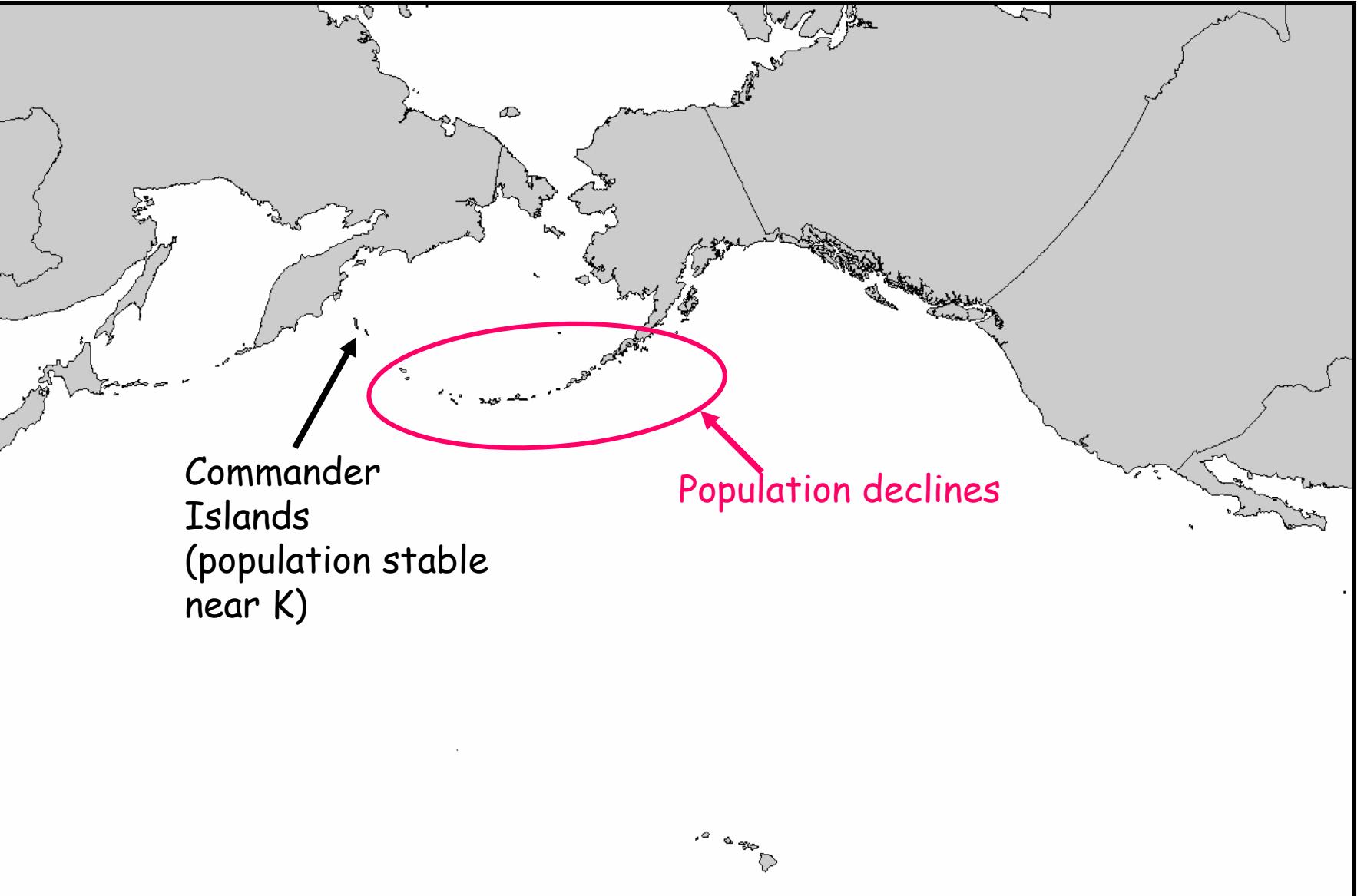
1790 1800 1810 1820 1830 1840 1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000

Year

Western Aleutians  
Temperatures from Corallines

# Commander Islands

1. Rationale--sea otter population has not declined
2. Summary of accomplishments and findings to date
3. Future plans



A grayscale map of the North Pacific Ocean and surrounding landmasses. A red oval highlights a cluster of small islands located to the west of the Kamchatka Peninsula and north of the Kamchatka Peninsula. A black arrow points from the text 'Commander Islands' to the western edge of the highlighted area. A pink arrow points from the text 'Population declines' to the eastern edge of the highlighted area.

Commander  
Islands  
(population stable  
near K)

Population declines

# Research Objectives

## Commander-Aleutian islands comparisons

- to better understand ultimate reasons for the decline
- to characterize physiology (health profile), behavior, and demography of sea otter population near K.
- to expand studies of sea otter-kelp forest interactions

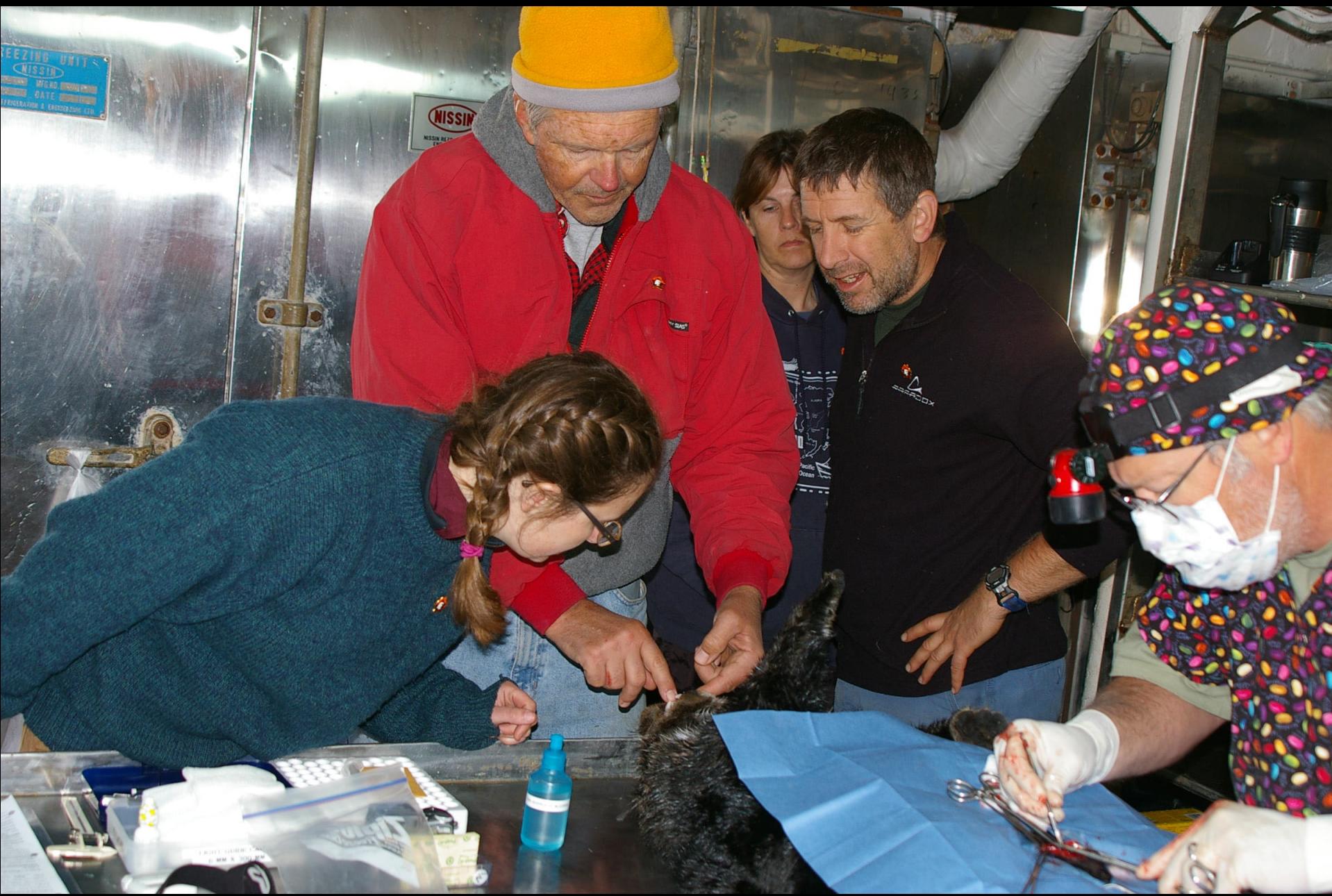








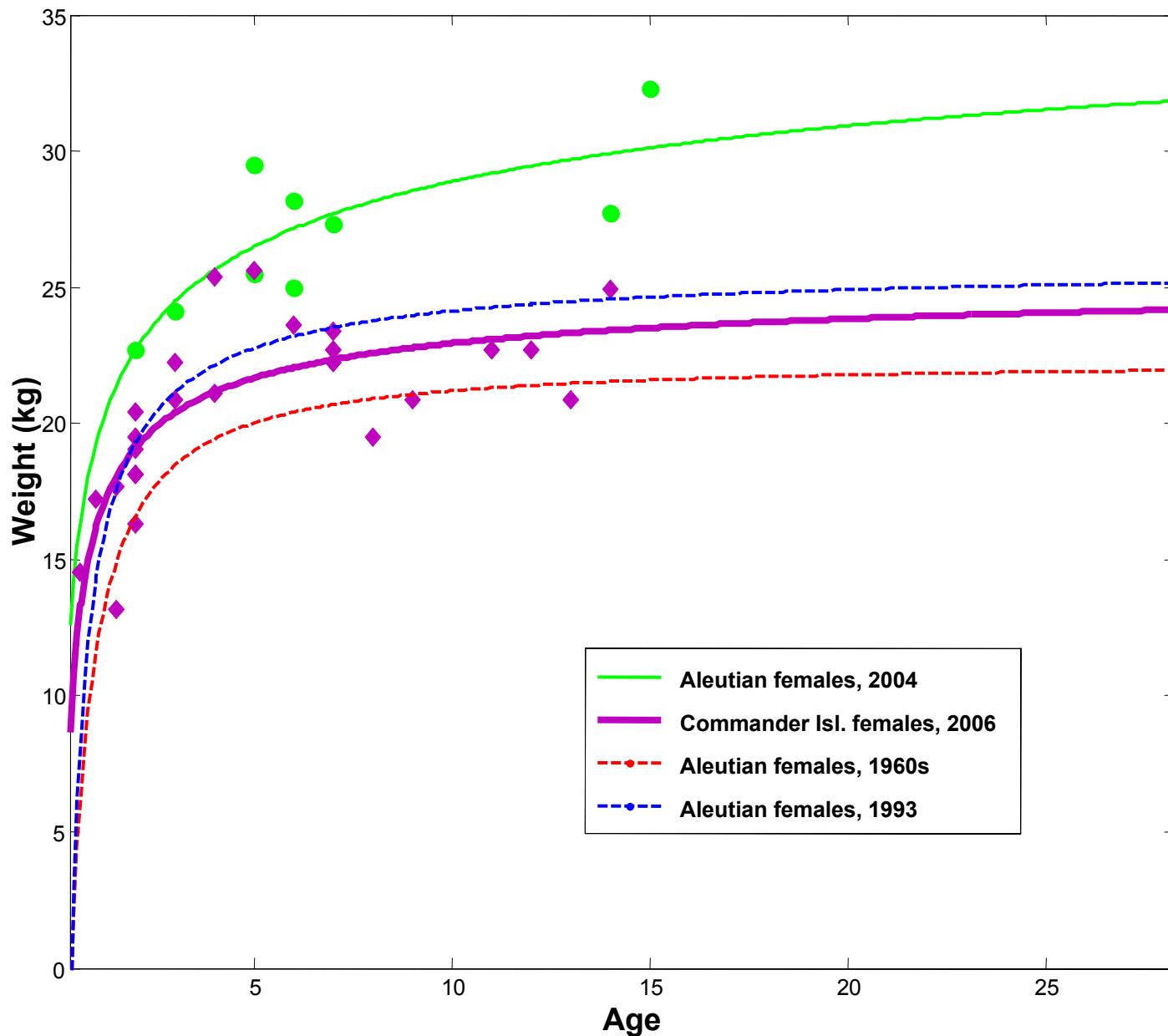


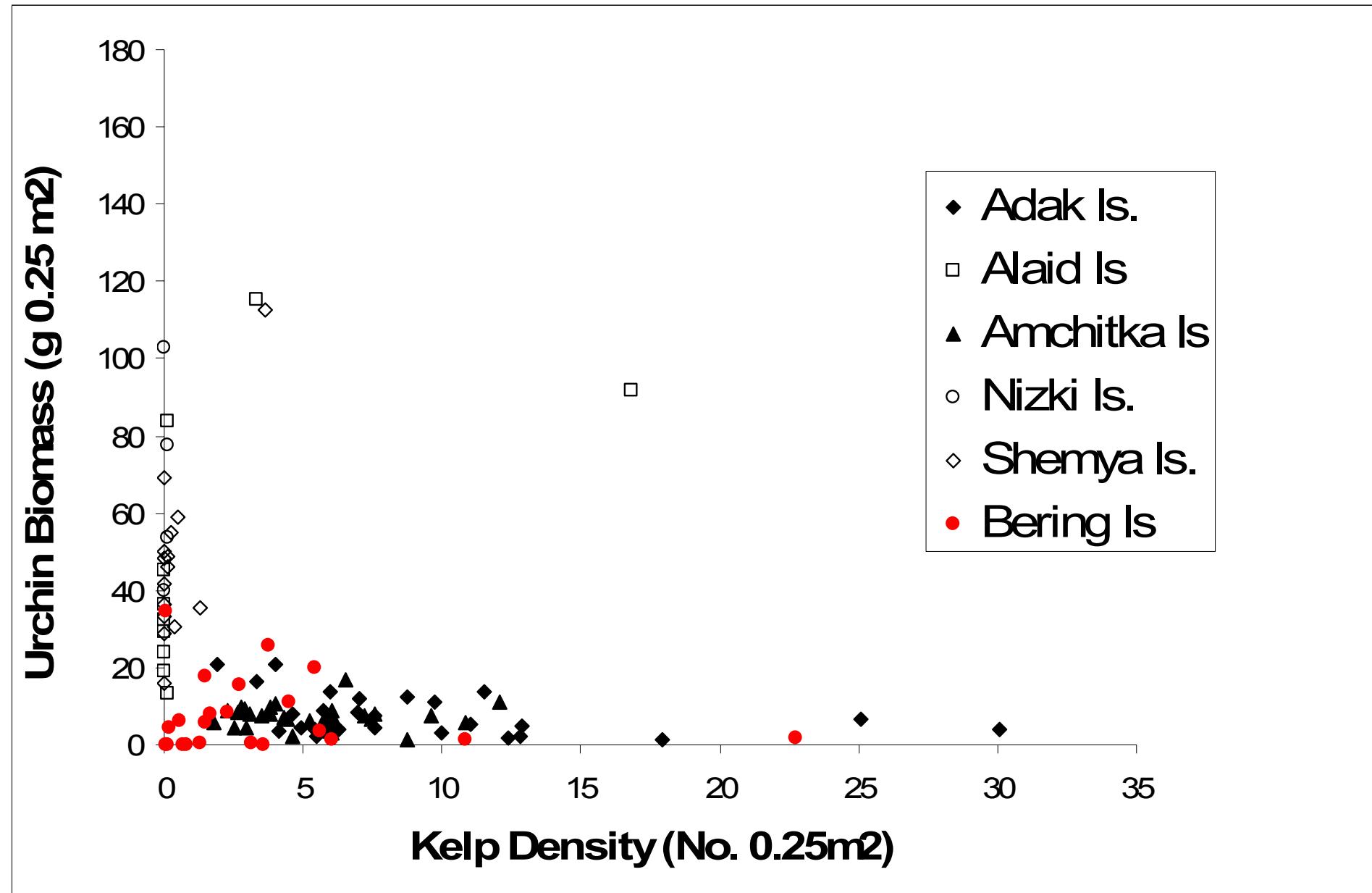






# Sea Otter Body Condition Comparison





# Future plans

- Field observations of tagged otters (survival, reproduction, diet & foraging behavior, movements)
- Recovery of TDRs (diving and activity)
- Continued work on kelp forest ecosystem